Draft Environmental Protection Agency Ecological Comments on the Department of Energy Oak Ridge Reservation Fifth Five-Year Review

GENERAL COMMENTS:

1. Interim Records of Decision (RODs) will address ecological protection in a final ROD in FY 2036-2037. Final decisions on remaining ecological risk concerns will be addressed in the future watershed RODs. The remedial action objectives (RAOs) for the interim RODs require that the remedy meet TDEC State Standards (AWQC).

2. White Oak Creek is listed as impaired for cesium and strontium in the 2020 TDEC 303(d) list. Anti-degradation provisions in TDEC water quality standards require minimization of inputs to impaired waterways of the constituents causing the impairment because the creek lacks capacity to accept additional contaminant loads. Table 3.8 indicated that strontium-90 (Sr-90) flux increased 7 percent compared to the 2001 to 2005 pre-remedial action average. ROD performance goals and Applicable or Relevant and Appropriate Requirements (ARARs) are not being achieved by the remedies. ARARs are not met because the Sr-90 flux is increasing in a waterbody that is 303(d) listed as impaired for strontium. The increasing flux of Sr-90 to White Oak Creek does not meet narrative requirements of TDEC standards. The 2020 Remedial Effectiveness Report (RER) attributed the ROD goal exceedances for Sr-90 flux in Bethel Valley (BV) at the 7500 Bridge Weir and in MV at the WOD to Sr-90 discharges from ungagged sources. The strontium flux increases are potentially related to performance issues of the groundwater extraction system at the Corehole 8 plume per DOE responses to comments on Specific Ecological Comment 4 on BV in the 2021 RER. The discharges of Sr-90 from ungagged sources in BV should be identified as a protectiveness issue for the BV Interim ROD. Please identify this as a protectiveness issue. Discuss potential causes and what will be done to address it.

3. Figure 1.3, Status of CERCLA response actions on the ORR, Page 1-18, indicated that ecological exposures to Melton Valley (MV) sediment and surface water would be addressed in a future ROD in FY 2036 (Figure 1.3). Please identify as a protectiveness issue the lack of a performance goal for polychlorinated biphenyls (PCBs) for surface water or fish tissue in the MV Interim ROD. Table 3.7 (Page 3-23) footnote "g" indicated that a remediation goal for compliance with AWQC was not identified for polychlorinated biphenyls (PCBs) in the MV Interim ROD. The TDEC State Standards (0400-40-03) include AWQC for PCBs for fish and aquatic life of 0.014 μg/L and 0.00064 μg/L for water and organisms.

4. Table 3.7 indicated that the maximum of grab sampling for PCBs at the White Oak Dam (WOD) was 0.0465 μg/L. The concentration of total PCBs in the surface water at WOD exceeded the AWQC. Section 3.1.4.2.2, AWQC screening, Page 3-27, explained that the exceedance was Aroclor-1254. Aroclor-1260 was detected at a maximum concentration above the AWQC for protection of aquatic life at three other surface water monitoring stations in MV (Table 3.9). According to Section 3.1.4.2.6,

largemouth bass samples in WCK 1.5 had the highest PCB concentrations, ranging from 1.1 to 2.6 μg/g on average from 2015–2020, above the PCB advisory level for human health and above Total Maximum Daily Load (TMDL) based impairment concentration of 0.02 μg/g. Total PCB concentrations in aquatic invertebrates and fishing spiders from WCK 2.3 exceeded concentrations from the reference site (HCK 20.6). Table 3.18, FYR summary for MV Interim ROD, Page 3-48, indicated no additional contaminant sources have been identified; however, Table 3.18 did not indicate whether sources had been investigated. The source of PCBs detected in surface water and fish tissues above the TDEC State standards is unknown. Additional studies to identify PCB sources were not discussed in the document. The MV Interim ROD lacked suitable performance metrics for long-term monitoring of PCBs. The MV Interim ROD does not appear to have evaluated sources of PCBs to surface water and sediment. Please identify these deficiencies as performance issues with the MV Interim ROD.

5. EPA has reevaluated the biouptake study and results in Tables 4.13 and 4.15 in the 2016 Five Year Review. DOE has not justified that the preliminary remedial goal (PRG) is within a 200–400 ppm range (Page E-9). EPA calculated the PRG for the Carolina wren with the linear regression with intercept and with the power model obtained by fitting a straight line to a log-log plot. Both the linear regression with intercept and the power model obtained by fitting a straight line to a log-log plot resulted in a PRG of 77 mg/kg for total mercury in floodplain soils (Tables 1-3). The predicted prey tissue concentrations are the same with both the linear model with intercept and the power model obtained by fitting data on a log-log plot (Table 1 & 2). The wider range of PRGs cited in Table E.1 was caused by DOE having modified the regression equations to remove the intercept from the linear regression or to take a derivative to the power equation. DOE also assumed limited methylmercury bioavailability. DOE has portrayed this issue as a range of outcomes based on uncertainty in models. However, the two models are predicting the same PRG. The main source of uncertainty in the models was from the changes DOE made to the models. DOE has not justified the validity of modifying the models with these changes.

- Linear regression $C_{bio} = m \times Cs + b$ was changed to $C_{bio} = m \div Cs + b$ in Table 4.13 of 2016 FYR.
- Linear regression $C_{bio} = m \times Cs + b$ was changed to $C_{bio} = m \times Cs$, i.e., intercept was dropped.
- Log10-log10 regression with intercept was changed from $C_{bio} = 10^{-0.1} \times (Cs)^{0.266}$ to $C_{bio} = 10^{-0.1} \times (Cs)^{0.266-1}$.
- The derivative of the power curve from the $\log_{10}$-$\log_{10}$ curve fit was taken at Cs of 307 mg/kg and the tangent to the curve was used as a bioaccumulation factor $C_{bio} = m \times Cs$, where m is the tangent to the power curve $C_{bio} = 10^{-0.1} \times (Cs)^{0.266-1}$ solved for Cs of 307 mg/kg.

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In the above equations Cs is the concentration of total mercury in the soil (mg/kg) and C_{bio} is the total mercury concentration in the tissue in mg/kg-dry weight. (mg/kg-dw). No scientific rationale or justification was provided for any of the modifications to the empirical models fit to the data. None of the modifications make any sense or are based in science.

6. Because the 2021 FYR is drawing from the evaluation of the biouptake study and resulting PRGs from the 2016 FYR, comments pertain to the 2016 FYR Section 4.1 and Appendix D as well as to the 2021 FYR, which draws on the results of the previous FYR.

7. Regardless of whether one uses the straight line fit to the biouptake data or the $\log_{10}$-$\log_{10}$ fit in Figure D.1.33 of Appendix D to the D2 2016 FYR the result is a preliminary remedial goal of 77 mg total Hg/kg-dw. Either the linear or power model is okay to use when the entire equation is used in its original form in Figure D.1.33. The equations should not be modified in any manner or the predictions of uptake into biota will be unreliable.

8. It is not okay to fit a line through the data and use only the slope part of the equation fit to the data to estimate dietary concentrations. It is not okay to fit a power curve to the data and then take the derivative of the equation solved for a specific concentration in soil. The derivative is the slope of the tangent to the equation and does not account for the intercept. The slope to the tangent depends on the concentration in the soil. The slope to the tangent (Table 4.13, third row) was evaluated for a total mercury concentration of 307 mg/kg in soil for an assumed 60% relative bioavailability of methylmercury in the diet at the site to methylmercury in the diet of birds in the study used to derive the critical dietary concentration. The slope to the tangent for assumed 60% relative bioavailability was used for the 100% relative bioavailability scenario. If the derivative was solved for a concentration in soil of 77 mg/kg, the slope to the tangent would be much greater and the PRG much lower. The slope to the tangent to the curve does not provide a reliable estimate of the concentration in biota. It does not make sense for DOE to take an equation they fit to the data and for DOE to not use the equation they fit but to use something else. It is not appropriate to take a derivative to the curve and use it to estimate uptake in biota.

9. Based on the data presented in the ORNL/TM-2016 Biouptake of Mercury by Lower East Fork Poplar Creek Invertebrates report and the February 15, 2018 Ecological Risk Presentation entitled Reevaluation of Lower East Fork Poplar Creek Floodplain Risks, the estimated remedial goal for protection of the Carolina wren would be well below the 200 to 400 ppm range if the equations fit to the biouptake data presented in Figure D.1.33 were used.

10. The population survey of Carolina wrens was not linked to exposure of wrens to contaminants. Methylmercury in blood or feathers was not measured in the study. It was assumed that wren exposure was lower at the Horizon Center. However, the

percentage of methylmercury in invertebrates was higher in the downstream study area (Section 10.1.4.2.2 Biological sampling, Page 10-17). The population study shows that Carolina wrens are present. Since wrens can be recruited into the floodplain, the population count is not necessarily sensitive to contaminant exposure. The contaminant exposures in the hot spots might end up killing half the young of birds that nest in those spots; but exposures to the hot spots will not kill off the entire population of Carolina wrens in the floodplain. Differences in habitat and low numbers confounded the results.

SPECIFIC COMMENTS:

1. *Section 3.2.4.2, Data Review, Page 3-58 and Figure 3.9, Changes in contaminant concentrations at the SRS.* The concentration of Sr-90 at the Sediment Retention Structure, while below the MV ROD Goal in 2020 appears to be increasing in the last 5 years. Please discuss how the deterioration of the SRS as it nears its design life could be influencing its performance to retain sediments from entering the Clinch River.

2. *Section 4.1.4.2.5 Corehole 8 extraction system, Page 4-40.* The description of the remedy performance of the Corehole 8 extraction system focused entirely on reductions in discharges to First Creek. The evaluation of protectiveness should also consider the releases of SR-90 from the ungauged sources per the discussion of contaminated groundwater escaping the extraction system and releasing to outfalls, as described in RER Specific Ecological Comment 4 and DOE responses. Upgrades and maintenance to the Corehole 8 extraction system are discussed in Section 4.1.4.4.2 Engineered remedies, Page 4-49. Section 4.1.6.1 Other findings, Page 4-55 indicated that additional investigations are required to determine sources of Sr-90 in BV that cause the ungauged Sr-90 flux issue. Section 4.1.6.1 should also discuss the upgrades and maintenance of Corehole 8 extraction system. Please enhance the discussion of the Corehole 8 remedy performance by referencing Section 4.1.6.1 and ungagged sources.

3. *Section 4.1.5.1.5 Corehole 8 extraction system, Page 4-53.* Please delete sentence, "There are no current, unacceptable exposures to ecological receptors." There was no evaluation of unacceptable ecological exposures for the Corehole 8 extraction system.

4. *Section 5.3.4.2.4 LTM, Page 5-73.* Long-term monitoring at the Environmental Management Waste Management Facility (EMWMF) included regular monitoring of stormwater and leachate for parameters in Table 5.21 and biennial monitoring of an extended list of parameters (Table 5.22). Potentially contaminated stormwater (contact water) and groundwater from a network of wells (leachate) are sampled. The detections are compared to background threshold values (TVs) and risk-based action levels. However, the thresholds in the long-term monitoring plan need reevaluation and better definition of actions required when thresholds are exceeded (Page 5-69). Table 5-29 indicated for one month in 2019 – 2020 elevated gross alpha activity and gross beta activity were detected in stormwater. Page 5-80 indicated that sporadic

detections of Sr-90 and other radionuclides above TVs were being evaluated as part of the ongoing data assessment. Comments on the 2021 RER indicated that Tc-99 and beta activity were detected at the EMW-VWEIR. DOE response to comment indicated "Elevated Tc-99 values in Bear Creek in November 2019 were a result of higher Tc-99 waste disposed at EMWMF associated with the uranium processing facilities at ETTP. Controls were in place at the EMWMF to limit Tc-99 in landfill wastewater to well below the discharge activities; however, an increase in this highly mobile contaminant was seen during this timeframe." The releases to EMW-VWEIR are associated with contact water. According to Table 5.28, contact water is regularly sample prior to discharge. The document should be revised to clarify how DOE manages the contact water and why the radionuclides are increasing at the EMW-VWEIR if contact water is sampled prior to discharge so it can be sent for treatment to the ORNL Liquid and Gaseous Waste Operations (LGWO) when necessary. This comment is seeking clarification of the radionuclide releases because there appears to be inconsistency among Table 5-29, text on Page 5-80, and comments on the 2021 RER.

5. *Section 7.3.4.2.1 Surface water monitoring, Page 7-35.* Releases of selenium from the Filled Coal Ash Pond (FCAP) are of potential concern to the health of fish in downstream Rogers Quarry. Selenium in filtered and unfiltered water at Stations MCK 2.05 and MCK 2.0 is regularly monitored as part of long-term monitoring of remedy effectiveness. Because selenium was not recognized as a contaminant of concern for pre-remedy baseline monitoring in 1996 (Table 7.17) there is no way to evaluate selenium by percentage reduction compared to baseline as is done for arsenic. Selenium concentrations upstream (MCK 2.05) and downstream (MCK 2.0) of the treatment wetland were compared to the TDEC 0400-40-03-.03(3) criteria continuous concentration (AWQC) for protection of fish and aquatic life for lotic (flowing water) systems (0.0031 mg/L). In 2020 the wet season samples contained selenium above the TDEC standard for lotic systems. The FCAP ROD does not specify compliance with lotic AWQC. Moreover, the FCAP ROD lacks a performance measure for selenium. The deficiency in the FCAP ROD is identified as a protectiveness issue with respect to identification of new contaminants or exposure pathways outside of the scope of the ROD. The remedial action objective for the FCAP was to "Reduce/eliminate contaminant entry into Upper McCoy Branch surface water through enhancement of wetland." Without a requirement to meet AWQC or other criteria for selenium, it is impossible to know whether the remedy has met its objective. Please identify what DOE is doing to address this issue.

6. *Section 7.3.4.2.3 Biological monitoring, Page 7-42.* Selenium concentrations in fish filets and fish ovaries were below the EPA-recommended tissue residue values in 2017 – 2020. Selenium detected downstream from the FCAP in McCoy Branch leading to Rogers Quarry in caged clams indicated a pattern of stable if not increasing concentrations downstream of the FCAP and Rogers Quarry (Figure 7-10). Arsenic concentrations in caged clams, however, decreased with distance from the FCAP. Selenium is not currently a problem in fish tissue. The ability for the remedy at the FCAP to reduce or eliminate selenium entry into McCoy Branch is unproven. The ecological component of Chestnut Ridge will be evaluated in a future FCAP ROD.

Please revise Table 7-20 next to the question: "Have new contaminants or contaminant sources been identified?" Replace "Data collected under ongoing post-RA monitoring are continuing to be evaluated." Replace or supplement with "Selenium contamination in stream banks and sediments downstream of the FCAP may serve as a potential ongoing contaminant source to McCoy Branch."

7. *Table 7-20, FYR summary for the FCAP/Upper McCoy Branch, Page 7-48.* Please revise note for item C, "Have ecological risks been adequately addressed at the site and, if not, is there a plan to address them through a future action?" Please revise the text to clarify that the actions taken in the FCAP wetland were effective in reducing exposures to arsenic throughout McCoy Branch. It is less certain whether actions were successful for reducing exposures to selenium throughout McCoy Branch (Figure 7-10). Please revise the text to limit the conclusion regarding McCoy Branch to arsenic and discuss the evidence of fish health in terms of selenium.

8. *Table 7-20, FYR summary for the FCAP/Upper McCoy Branch, Page 7-48.* As described in Section 7.3.2.5 on Page 7-31, the dam and spillway are inspected following an intense rainfall. Please revise Table 7-20 to include in the notes regarding the susceptibility to natural disasters the concerns regarding the vulnerability of the dam to intense rainfall events and what is being done about it.

9. *Section 7.3.5.2.2 Risk, Page 4-79.* Revise text in second paragraph of Section 7.3.5.2.2 to discuss the issue for selenium in Table 7.16 and actions taken to close out the issue in the 2019 RER. The last sentence in this paragraph, regarding no information having changed ignores the new information collected since the 2016 FYR for selenium. Please enhance the discussion of selenium investigations, what was found, and how it affects remedy performance.

10. *Section 7.3.6, Issues and recommendations, Page 7-50.* Text currently says there were no issues or recommendations. Since the purpose of the remedy was to reduce contaminant transport in surface water to McCoy Branch, include a discussion of how the remedy is effective in minimizing arsenic transport but is less effective in eliminating selenium transport but that the fish tissue concentrations of selenium are below the risk-based criteria. Revise text to discuss the issues identified in these comments and whether there are any recommendations for follow on monitoring.

11. *Section 8.1.5.3, Page 8-46.* Revise text to state that although the total of PFOS and PFOA concentrations in surface water at the exit pathway locations were below the PRG of 70 ng/L, Figure 8.8 showed a total of PFOS and PFOA of 70.2 ng/L at MIK 0.39 in Mitchell Branch below the K-1045-A Fire Training Area. Since the concentration in surface water presumably originated from contaminated groundwater, please discuss whether it is possible for groundwater concentrations to exceed the PRG, which appears to apply to groundwater, and whether more sampling is needed.

12. *Section 8.5.7 Protectiveness Statement, Page 8-112.* The protectiveness statement was "The ETTP Ponds will be protective of human health and the environment once

the RAOs have been met." It has been since 2007 when the operational monitoring began, and the ponds are still in operational monitoring versus performance monitoring. Manipulation of the ponds to create the desired biological conditions is ongoing. Favored conditions do not appear to be self-sustaining in K-1007-P1 Pond as was the goal of the remedy to reach a desired, self-sustaining end state of a bluegill dominated population and a fully vegetated pond. The K-1007-P1 Pond has not demonstrated the ability to approach a state where it meets RAOs without ongoing maintenance. Not sure if it will be protective in the future if it is not protective now.

13. *Please correct MBh to MB on Page 8*-121.

14. *Appendix E, Mercury Biouptake Along the Lower East Fork Poplar Creek Floodplain, Section E.1.3. Remedial Goal Calculations, Page E-8.* The formula for the concentration in soil contains a term ABS for the fraction of the dose absorbed. However, the remedial goal calculation was not based on a dose. The comparison is to the critical methylmercury concentration in the diet. It is inappropriate to use an assumption that only a portion of the methylmercury was absorbed from the diet at the site relative to the proportion of the methylmercury absorbed from the diet in the study of the critical tissue concentration. The administered compound was methylmercury in the diet in the study used to derive the critical concentration. No ABS factor should be used when calculating the PRG. ABS apply to situations where the form of the compound administered in the study is different from the form of the compound at the site or if the route of administration in the study was different from the route of administration at the site. Since like is compared to like here, there is no justification for an ABS. Please correct Table E.1 to remove the rows for ABS and or FI less than 1.

15. *Appendix E, Mercury Biouptake Along the Lower East Fork Poplar Creek Floodplain, Section E.1.3. Remedial Goal Calculations, Page E-8.* The fraction of the diet from the contaminated area (FI) is accounted for by the spatial averaging of concentrations within the home range. The PRG is compared to the spatially averaged concentration. No correction to the PRG for the FI is necessary or appropriate as this is accounted for by spatial averaging of floodplain concentrations.

16. *Page E-9.* Text indicated assumptions from the 2015 study do not differ from the LEFPC ROD and would not change the calculation of the PRG from a range of 200 to 400 ppm. However, the percentage of methylmercury in the prey items in the original ROD was 4% and we now know that this was an underestimation based on the South River study and the site-specific study. The observed average percentage of methylmercury in wolf spiders was 59% excluding the reference locations (Fourth FYR Table 4.14). Compare with the original assumption in the 1994 RI Addendum of 4% methylmercury. This is a significant change affecting remedy protectiveness. For the prey items in the Carolina wren's diet the percentage of methylmercury was 27.3% in detritivore insects and 15.9% in herbivore insects. In all cases the site-specific percentage of methylmercury was substantially greater than 4% originally assumed in the 1994 RI Addendum used to support the remedy decision. The sentence on Page E-9 should be revised.

17. *Table 4.15 of the 2016 D2 FYR*. The two rows in Table 4.15 are okay; but Model 3, the log-log regression with the intercept, was calculated incorrectly. Model 3 provided the same result for the PRG as Model 1 for the Carolina wren. The 163 mg/kg for Model 3 should be changed to 77 mg/kg. Model 4 and Model 5 make no sense. It makes no sense and does not fit the data to remove the y-intercept for Model 4. The practice of removing the y-intercept from the biouptake equation underestimates the mercury detected in the tissue in the site-specific study. It makes no sense to take a derivative of the power curve for Model 5. The ABS and FI factors are not appropriate to apply.

18. *2016 FYR Table 4.13*. Table 4.13 of the D2 2016 FYR is incorrect. The evaluation should be redone for the 2021 FYR using the correct equations. The equation for the linear regression for the herbivore is $C_{herbivore} = 0.0013 \times Cs + 0.024$ according to Figure D.1.33. Please correct Table 4.13. Note that the slope is multiplied by the concentration in the soil not divided. The equation fit to the data on Figure D.1.33 for the worm was $Hg(worm) = 10^{-0.2088} \times Cs^{0.6311}$. One is not subtracted from the exponent. Please correct the equations.

19. *Table E.1*. The straight-line model with intercept and the log-log power model yield nearly identical estimates of the prey concentrations, and the PRGs derived by each model are the same. The range of PRGs for the Carolina wren in Table E.1 should be changed from 77 to 215 (wren) to 77 to 145. Methylmercury in the diet is methylmercury in the diet. No correction for ABS or FI is required. For the shrew the range of PRGs was 207 to 246 mg/kg.

20. *2016 FYR Table 4.13*. The values of 0.07458 for the worm, 0.0004 for the herbivore, 0.03136 for the detritivore, and 0.00896 for the spider in Table 4.13 were derived by taking the derivative of the log-log regression plots in Figure D.1.33. The derivative is the expression in the fourth row of the table. It has a 1 subtracted from the exponent. The derivative is the slope of the tangent to the bioaccumulation curve. Since the power curve bends towards the x-axis the slope of the tangent to the curve decreases as the concentration in soil increases. The slope of the tangent yielding the values in the third row (beginning with 0.07458) is for a concentration in soil (Cs) of 307 mg/kg. The 307 was in Table 4.15 as the PRG for the wren assuming ABS or FI of 60%. The document presented that this was done but did not provide a technical justification for using the slope of a tangent to the bioaccumulation curve in a calculation of a PRG. No justification was provided for using a slope of a tangent to the curve instead of using the linear model with the intercept if a linear model was desired. No justification was provided for using 307 mg/kg as the concentration in soil as the position of the tangent.

21. *Table E-3, Page E-15*. Text on Page E-15 indicated while some of the concentrations within the 1.75-acre home range of the Carolina wren were within the range of 200–400 ppm total mercury in soil, the potential exposure concentration is less. Table E-3 showed several 1.75-acre stations with mercury concentrations above 200 ppm.

No justification was provided why exposures would be to less than 200 ppm. No justification was provided for averaging the results for the 1.75-acre plots or taking the 95% upper confidence limit on the mean. Text on Page 10-27 indicated the ecological receptors would be exposed to at most 155 to 178 mg/kg of mercury in the floodplain soils. However, Table E-3 shows there are some smaller areas within the home ranges that have concentrations above 200 mg/kg. The decision unit for the evaluation was the 1.75-acre home range. Please clarify how the conclusion of 155 to 178 mg/kg was arrived at. It appears the size of the decision unit was increased to estimate a summary statistic. It is not appropriate to use a summary statistic over a larger area. The intent of the evaluation was to examine potential localized areas of higher concentrations.

22. *Section 10.1.5.2 Question B: Are the assumptions used at the time of remedy selection still valid? Page 10-25.* The assumption at the time of the remedy selection was that most of the flux of mercury in LEFPC was from Y-12. Today we know that the flux of mercury occurs throughout the creek and not just from the upstream sources to the surface water. The strategy to delay addressing the creek bank and creek bottom sediments to after the upstream sources are addressed should be reconsidered in light of the recent findings that downstream fluxes of mercury are more important in the downstream portions of the creek where contamination appears to be spreading. Concentrations of mercury in EFK 6.3 fish are increasing over time. The remedy to treat surface water at the upstream sources in Y-12, while helpful, is not addressing the larger downstream problem. The largest source of contaminant spread in the environment in the downstream reach should be addressed with higher priority.

23. *Table 10.6.* Table 10.6 indicated erosion of creek bank soils and potential recontamination of floodplain soils will be addressed in a future ROD. The evaluation of recontamination of the floodplain above a remedial goal of 400 ppm concluded it was unlikely for creek bank erosion to contaminate floodplain soils to over 400 ppm. However, the average mercury concentration in the suspended sediments of 30 ppm moving downstream from more contaminated upstream areas is greater than the average concentrations in downstream creek banks and creek beds. There is mercury moving through the system that could spread mercury downstream albeit not at concentrations above 400 ppm. Please discuss how much of the mercury in the suspended sediments is attributed to erosion of floodplain soils versus creek bank erosion.

24. Table 10.12 and Figure 10.8, Pages 10-44 and 10-45. Please identify as an issue and discuss the trend in the last five years of increasing PCB concentrations in channel catfish at Station PCM 1. Please discuss how PCB concentrations in channel catfish are highest at Station PCM 1 near the K-1007-P1 Pond outlet (Table 10.12). Discuss whether releases of PCBs and mercury from the K-1007-P1 Pond are a continuing source of contamination to Poplar Creek.

25. *Table 10.15, FYR Summary for LWBR.* Under the question of whether there have been any changes in the standards identified as ARARs please include TDEC Total Maximum Daily Loads (TMDLs) (TDEC 2010a,b,c) as updates to the standards.

Table 1. Comparison between the linear model with intercept and the log10-log10 model of predictions for total mercury concentrations in prey items in the diet of the Carolina wren

Dietary Item	Model (Figure D.1.33)		Total Mercury Concentration in Biota (dry weight), C_{bio}, for Concentration in Soil, Cs, when Cs = 77 mg/kg	
	Linear Regression	Log_{10}-Log_{10} Power Curve	Linear Regression	Log_{10}-Log_{10} Power Curve
Spider	$C_{bio} = 1.697 + 0.011 \times Cs$	$C_{bio} = 10^{-0.1} \times (Cs)^{0.266}$	2.54	2.52
Detritivore	$C_{bio} = 1.798 + 0.0366 \times Cs$	$C_{bio} = 10^{-0.343} \times (Cs)^{0.538}$	4.62	4.70
Herbivore	$C_{bio} = 0.0241 + 0.0013 \times Cs$	$C_{bio} = 10^{-1.7557} \times (Cs)^{0.3638}$	0.124	0.085
Plant	$C_{bio} = 0.05 \times Cs$	NA	3.85	

Table 2. Conversion of dry weight concentrations of total mercury in prey items in the diet of the Carolina wren to wet weight concentrations of methylmercury in prey items with average percentages of methylmercury and dry to wet weight conversion factors in Table 4.14 of 2016 FYR.

Dietary Item	Proportion of Diet of Carolina Wren	Parameter		Methylmercury Concentration in Biota (wet weight) when Concentration in Soil for Cs = 77 mg/kg*	
		Methylmercury Fraction of Total Mercury	Dry to wet Weight Conversion Factor	Linear Regression	Log_{10}-Log_{10} Power Curve
Spider	0.3	0.59	0.3	0.45	0.45

Detritivore	0.15	0.273	0.31	0.39	0.40
Herbivore	0.45	0.157	0.49	0.01	0.007
Plant	0.1	0.033	0.25	0.032	

*The methylmercury concentration in biota was the total mercury concentration in Table 1 multiplied by the methylmercury fraction and multiplied by the dry to wet weight conversion factor.

Table 3. Calculation of the concentration of methylmercury in the diet of the Carolina wren when the concentration of total mercury in the soil is 77 mg/kg for two models.

		Methylmercury Concentration in Biota (wet weight) when Concentration in Soil for Cs = 77 mg/kg		Methylmercury Concentration in Biota (wet weight) Multiplied by Dietary Proportion	
Dietary Item	Proportion of Diet of Carolina Wren, Pi	Linear Regression	Log_{10}-Log_{10} Power Curve	Linear Regression	Log_{10}-Log_{10} Power Curve
Spider	0.3	0.45	0.45	0.135	0.135
Detritivore	0.15	0.39	0.40	0.059	0.06
Herbivore	0.45	0.01	0.007	0.005	0.003
Plant	0.1	0.032	0.032	0.0032	0.0032
Sum of product of dietary proportion of prey item and methylmercury concentration in prey				0.2	0.2

Notes for Table 3:

The critical methylmercury concentration in the diet of the Carolina wren was 0.2 mg/kg-wet weight.

The concentration of total mercury in the prey items of the Carolina wren was given by fitting the biouptake data to straight line regressions in Figure D.1.33 of Appendix D to the 2016 FYR. The second plot on Figure D.1.33 was the fits to the log-log plots.

The proportion of total mercury in dietary items that was methylmercury was obtained from Table 4.14 of the 2016 FYR. the following calculations are made for the PRG for the Carolina wren.

Critical Dietary Concentration for the wren = 0.2 = $\Sigma(C_i \times P_i)$

Where C_i is the concentration of methylmercury in the dietary item on a wet weight basis. P_i is the proportion of the dietary item in the diet.

The RGO using the equations provided for bioaccumulation and methylmercury in biota is 77 because the sum of the concentrations in the dietary items multiplied by the dietary fractions adds up to the critical concentration of 0.2 mg/kg-ww of methylmercury.

$0.2 = 0.3 \times 0.45 + 0.15 \times 0.39 + 0.45 \times 0.01 + 0.1 \times 0.032$ (linear equation with intercept)

$0.2 = 0.3 \times 0.45 + 0.15 \times 0.40 + 0.45 \times 0.007 + 0.1 \times 0.032$ ($\log_{10}$-$\log_{10}$ plot)

REFERENCES:

TDEC 2010a. Proposed Total Maximum Daily Loads (TMDLs) for Polychlorinated Biphenyls (PCBs) and Chlordane in Melton Hill Reservoir: Lower Clinch River Watershed (HUC 06010207), Anderson, Knox, Loudon, and Roane Counties, Tennessee.

TDEC 2010b. Proposed Total Maximum Daily Loads (TMDLs) for Polychlorinated Biphenyls (PCBs) and Chlordane in Watts Bar Reservoir: Watts Bar Lake Watershed (HUC 06010201), Lower Clinch River Watershed (HUC 06010207), and Emory River Watershed (HUC 06010208), Loudon, Meigs, Morgan, Rhea, and Roane Counties, Tennessee.

TDEC 2010c. Proposed Total Maximum Daily Loads (TMDLs) for Polychlorinated Biphenyls (PCBs) and Chlordane in Fort Loudon Reservoir: Fort Loudon Lake Watershed (HUC 06010201), Blount, Knox, and Loudon Counties, Tennessee.